Principles for Efficient and Reliable Reactive Power Supply Consumption

March 8, 2005

Williams Power Company

Robert P. O'Connell

The “Reactive” Road Ahead

The FERC Staff'stechnical report on reactive power is a comprehensive assessment of the state of the technical and regulatory issues surrounding the planning, operation and commercial aspects of reactive power in the industry today. The six problems and concerns regarding the procurement practices and pricing policies and the four broad recommendations identified in the technical report are important issues to merchant suppliers.

Every category of market participant - transmission owner, generation owner, load serving entity, distribution owner, and end-use customer – has the potential to supply reactive power. From a jurisdictional standpoint there are potential inconsistencies between federal and state jurisdiction. From an economic standpoint it is desirable to optimize procurement of reactive power with market participants responding to effective price signals. Clearly merchant suppliers can and do supply reactive power and yet today they are not always compensated in a direct manner. Clearly some stakeholders have an interest in maintaining the status quo – which does not provide for comparable treatment. Williams is convinced that all those who provide reactive power, either actually delivered or maintained in reserve, should be compensated and that the basis for compensation should be the value of that reactive power.

The transmission owner is the linchpin of the current reactive power paradigm. The transmission owner influences the planning policy, planning standards and the design of the transmission system. The transmission owner influences the type, amount, and location of reactive power resources even through the development of models used in technical studies to quantify the reactive power needs of the system. The transmission owner influences the operating policies, operating standards, real-time performance and overall compliance with those policies and standards for reactive power resources. The transmission owner influences the compensation mechanisms for reactive power. The transmission owner, and possibly its affiliates, is also a major supplier of reactive power. And if integrated with the distribution company, the transmission owner must comply with certain service standards for the end-use customer. In its discussion on the role of electric industry restructuring in the August 14th blackout, the Michigan Public Service Commission stated: “Placing authority or any significant control over grid reliability decisions in the hands of companies with a commercial interest at stake must be prevented.”[1]

[1] Michigan Public Service Commission, “Report on the August 14th Blackout,” November 2003, p. 27. http://www.michigan.gov/documents/mpsc_blackout_77423_7.pdf

In some cases there is insufficient understanding of the importance of reactive power and of the behavior of aggregate load in consuming reactive power. While in most instances the generating station staff is aware of the need to control the voltage at the bus to which the station is connected, the same staff may not fully appreciate the need or urgency associated with a request to maximize reactive power production. A more thorough understanding of the value of reactive power in those situations may result in more creative responses. In making decisions about the need for and value of reactive power, particularly at different locations during the most difficult times of the year, engineers in both planning and operating functions need fully vetted tools and techniques to resolve assumptions that heretofore have been unchallenged. The limited ability to transport reactive power between regions complicates this analysis.

All synchronous generators can and do produce reactive power regardless of ownership. All synchronous generators use the same approach to producing reactive power. The generator controls voltage to meet its voltage schedule by adjusting its reactive power output using a voltage regulator. The transmission system operator or dispatcher establishes the voltage schedule, which every generator must follow. Assigning a voltage schedule is functionally equivalent to directing the production of reactive power.

Merchant suppliers are required, through provisions of their interconnection agreements, to produce reactive power. An example of this type of requirement is included in the interconnection agreement between Tenaska Alabama Partners, L.P. and Southern Company Services, Inc. "When Tenaska is connected or delivering power to the Alabama Power Electric System, Tenaska shall operate its generation to meet the voltage schedule, as measured at the 500 kV transmission bus serving the Facility, provided by Alabama Power. ... If Tenaska cannot hold voltage schedule but is producing its maximum amount of MVARs, then that is acceptable performance."[2]

Some interconnection agreements require merchant suppliers to replace their facility's reactive power capability in the event the facility is incapable of maintaining deliveries within the design levels. An example of this type of requirement is included in the interconnection agreement between Kinder Morgan Michigan, LLC and Michigan Electric Transmission Company, LLC. "In the event the Facility is unable to consistently maintain a reactive power capability sufficient to maintain a power factor at the Point of Receipt within the Facility's Reactive Design Limitations, the Generator shall take appropriate other steps to configure to meet such standards, including, as

[2] ER00-1608-000, p. 29.

necessary, the installation of dynamic reactive power compensating devices subject to prior review and approval by Transmission Owner."[3]

From an operational perspective dispatchers prefer to have reactive power reserves particularly in areas of the system that have limited generation. In systems that have shunt capacitors, dispatchers prefer to energize the shunt capacitors as early as possible and to de-energize them as late as possible. Operating in this manner allows dispatchers to maximize reactive power reserves in generating resources. These reserves offer dispatchers the opportunity to respond to the changing needs of the system without careful consideration of the potential for a capacitor to fail during switching. Dispatchers have learned that maintaining a healthy voltage profile is an underpinning of reliable operation.

Merchant suppliers are committed to supporting the reliability of the electric system and stand ready to do so when called. Merchant suppliers must respond quickly to any opportunity to fill the needs of the market. Merchant suppliers must also respond to any request from the control area dispatcher because of the requirements of their interconnection agreements.

Merchant suppliers make a substantial contribution to reliability through their integrated operation into the transmission system. This fact was identified in several reports on the August 14th blackout. In its report on the blackout, the Michigan Public Service Commission stated: "The return of generation at the Whiting facility and the restarting of generators at Kinder Morgan power plant were a top priority. These units provide both local power supply and area voltage support."[4] That Commission also stated: "With the southeastern portion of the Consumers Energy/METC system returned to a normal situation, except for the Whiting Generation and the 138 kV ties to ITC and NIPSCo, seventy-five percent of the power supply to the affected area was coming from the Kinder Morgan power plant…"[5]

The Kinder Morgan power plant is owned by an affiliate of Kinder Morgan, Inc. The plant disconnected from the grid on August 14th at 16:10 EDT as a result of the system collapse and was re-connected to the grid at 16:48 EDT that same day. Even though the plant was one of the first units to return in that area to support the recovery efforts, it took the merchant over three months to find a party willing to accept responsibility for its cost of operation during the recovery efforts. Not

[3] EL03-12-003, §6.6.2, p. 18.
[4] Michigan Public Service Commission, p. 51.
[5] Michigan Public Service Commission, p. 52.

only did the merchant receive insufficient compensation to recover its cost of operation for the energy produced but also the value of the service that plant provided to the system during that recovery was, and still remains, wholly uncompensated.

Some transmission operators have proposed to enact or have enacted mandatory performance testing requirements for generators to receive compensation for reactive power. Some of these transmission operators have crafted these requirements to exclude from compliance a significant portion of the generating facilities in the system. Merchant suppliers support the concept of performance testing particularly for a service so inextricably linked to reliability as reactive power supply is. Merchant suppliers believe the standards and metrics for these tests must be clear, fair and transparent. These tests must also be available on a reasonable basis. Merchants also support the testing of all generating facilities.

The industry needs a new paradigm to move these reactive power issues from debate to reality. The end of selective compensation and other forms of discrimination must be at the forefront of this effort. For many the need to provide reactive power has already been established within interconnection agreements. The transmission tariffs must address the compensation payments. Compensation mechanisms eventually must recognize the differences in location, in resource type – static capacitors, static VAR compensators, synchronous condensers and generators – and in control capabilities. Payments need to recognize the value of reserves. The critical issue is what is available to assist in surviving an unexpected event.

The system of the future must clearly encourage all market participants to make decisions that result in the right outcome. These participants should expect to receive and must receive a reasonable return on investments made in that regard. Equipment must be sized and purchased efficiently. Operation of equipment must be aligned with those global goals. While accomplishing all of this, one cannot forget the importance of having flexibility to respond to events beyond the imagination.

While we recognize the challenge of revising current mechanisms, Williams emphasizes that the following elements of tariff redesign must be considered and reflected in each OATT.

1) All generators should have the same opportunity to provide reactive power.
2) Reactive power should be provided and compensated on an unbundled basis.
3) Compensation for reactive power should be based on its value to the market.

4) The current cost-based approaches are reasonable relative to the cost of other reactive power resources and acceptable as an interim solution to price discrimination.
5) Efforts to “qualify” potential suppliers must not be allowed to protect historic suppliers while disadvantaging bona fide potential merchant providers.
6) Customers must be given the opportunity to self-supply reactive power.

Clearly this list of issues leaves important questions unanswered. But just as clearly, the current approaches to reactive power are neither fair nor likely efficient. Williams applauds the Commission’s willingness to explore this opportunity to bring the full benefits of competition to consumers.

Williams Power Company, Inc. is an energy services provider that buys, sells, and transports a full suite of energy and energy-related commodities, including power, natural gas, primarily on a wholesale level. Williams Power Company’s portfolio consists of approximately 7,500 megawatts of capacity owned, managed or under long-term contract within five of the ten North American Electric Reliability Council (NERC) regions. The Company's largest position is in southern California, where Williams supplies approximately 35 percent of that region's electricity needs.

Robert O’Connell is the Manager of Technical Services for Williams Power Company. His responsibilities include engineering issues for Williams Power Company's contractual and physical assets, including the operation and maintenance of Williams Power Company’s generating station located in Hazleton, Pennsylvania. Of his 22 years of experience in the electric power industry, Mr. O’Connell has 13 years of experience in transmission system planning and power system operation functions for an investor-owned utility. Mr. O’Connell has a Bachelor of Science Degree and a Master of Science Degree in Electrical Engineering from Drexel University and he is registered as a professional engineer in the Commonwealth of Pennsylvania.